CFO cultural background and stock price crash risk

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Abstract

We investigate the relation between the cultural background of chief financial officers (CFOs) and stock price crash risk. Using a novel single-country setting in the U.K. market, we find robust evidence that CFOs from cultural backgrounds that emphasise uncertainty avoidance are negatively associated with firms' stock price crash risk. Our evidence further shows that the effect of CFO uncertainty avoidance is more pronounced for firms with higher information asymmetry and riskiness, and when CFOs have a greater ability to influence firm decisions. Overall, the results shed light on the important role of CFO cultural background for firm policies and outcomes.

Keywords: Managerial cultural background, Uncertainty avoidance, Stock price crash risk

JEL Classification: G10, G12, G14

Highlights:

- We explore the relationship between CFO cultural background and stock price crash risk.
- CFO with stronger uncertainty avoidance is associated with lower price crash risk.
- The effect of CFO cultural background is more pronounced for firms with higher information asymmetry and riskiness.
- The effect of CFO cultural background is more pronounced when CFOs have a greater ability to influence firm decisions.
- Our results highlight the important role of CFO in corporate financial decisions and outcomes.

1. Introduction

Stock price crash risk, which measures asymmetry in the return distribution, especially downside risk, is a fundamental issue in the asset pricing literature. It has received increasing attention from the media and regulators since the 2008 financial crisis. Given that extreme bad cases can lead to non-negligible losses for investors, examining the determinants of stock price crash risk is crucial. There is a vast prior literature that has documented how firm-level characteristics are attributable to variations in price crash risk. However, few studies have explored the impact of managers' idiosyncratic characteristics, which are an important factor (Andreou et al., 2017; Kim et al., 2016b). Among those, cultural aspects have generally been underexplored, and this paper aims to fill that void in the literature. Specifically, we investigate whether and how the cultural background of chief financial officers (CFOs) affects future stock price crash risk.

This study is motivated by upper echelons theory, which argues that the top management team's background characteristics are key predictors of organisational behaviours and outcomes (Hambrick and Mason, 1984). Bertrand and Schoar (2003) document that top managers have statistically and economically significant effects on corporate behaviour. Furthermore, prior literature (e.g., Brochet et al., 2018; Du et al., 2017; Nguyen et al., 2018) has confirmed that cultural background has a significant influence on corporate decisions and outcomes (e.g., analysts' forecasting accuracy), information disclosure, and firm performance under pressure. In this study, we focus on the uncertainty avoidance index (UAI) in Hofstede et al.'s (2010) cultural dimensions. Prior research suggests that, among Hofstede's six cultural dimensions, uncertainty avoidance most strongly affects corporate financial decisions (e.g., Kwok and Tadesse, 2006; Kanagaretnam et al., 2014; Nguyen and Truong, 2013; Pan et al., 2017). Thus, we believe it is the most relevant cultural dimension for our study.

According to the agency theoretic framework, price crash risk arises from the information asymmetry between corporate insiders and external stakeholders (Jin and Myers, 2006). Managers may hoard bad news for various reasons, but their ability to do so is limited. Therefore, when the accumulation of bad information passes a certain threshold, it will be revealed to the market all at once, leading to a stock price crash. Following Jin and Myers (2006), we propose that managers with different cultural values inherited from their ancestors may have different attitudes toward exploiting information asymmetries (i.e., withholding negative information from shareholders).

Uncertainty avoidance, which captures a society's tolerance for uncertainty and ambiguity, provides an interesting link to our research question. According to Hofstede et al. (2010), individuals with strong uncertainty avoidance will try to control the future and maintain rigid codes of belief and behaviour. We expect that executives with strong uncertainty avoidance will prefer to avoid future uncertainty and ambiguity for their firms, and will therefore be less likely to hoard, and more likely to reveal, up-to-date bad news to the public. As a result, we hypothesise that firms whose executives have stronger uncertainty avoidance cultural backgrounds will experience lower stock price crash risk.

To examine our hypothesis, we first use a novel single-country setting, which allows us to investigate cross-country cultural impacts without the correlated omitted country-level factors, such as economic conditions, dominant religions, legal origins, and governance quality. The U.K. market provides an ideal context, because U.K. firms have high proportions of foreign executives with diverse nationalities (Conyon et al., 2018), thus enabling us to investigate the cultural background of executives directly. Second, we focus on CFOs instead of CEOs. This is because CFOs' duties are primarily financial, and they are responsible for reporting accurate and timely financial information (Ham et al., 2017). Kim et al. (2011) argue that CFOs have more financial expertise and a greater influence over firms' financial decisions

than CEOs. In addition, examining the impact of CFO cultural background in U.K. firms is especially relevant because, in the U.K., CEOs tend to be less powerful than in the U.S. (Keenan, 2004; Aguilera et al., 2006).[1] CFOs in the U.K. are also more likely to play a more significant role in their firms than those in the U.S. (Florackis and Sainani, 2018).[2]

We construct a sample of public firms that are constituents of the FTSE All-Share Index between 1999 and 2015. This sample is representative, capturing approximately 98% of the U.K.'s market capitalisation. We obtain data from three main sources: BoardEx, Datastream, and Hofstede's cultural dimensions. The final sample consists of 703 unique firms, 1,340 unique CFOs, and 6,531 firm-year observations, and contains 106 unique foreign CFOs (426 firm-years with non-U.K. CFOs) from 17 countries.

We present several important findings. First, our main results reveal a negative and significant relation between CFO uncertainty avoidance and firm-level stock price crash risk, consistent with our expectation that the uncertainty avoidance tendency embedded in CFO cultural background affects the risk of future stock price crashes. Our results are robust to controlling for CEOs' and board of directors' cultural backgrounds as well as addressing endogenous concerns using firm fixed effects regression models, a difference-in-differences specification, and a propensity score matching procedure.

Second, in additional analyses, we explore the potential channels of how CFO cultural background affects stock price crash risk. Specifically, we find that the effect of CFO uncertainty avoidance on crash risk is more pronounced when firms have more severe information asymmetry (i.e., lower analyst following, higher bid-ask spreads, lower financial

[1] Keenan (2004) finds that the same person holds both the chairman and CEO titles in approximately 75% of S&P 500 companies in the U.S. In contrast, such CEO duality is very rare in U.K. companies. Aguilera et al. (2006) highlight that a CEO's exercise of power may be further constrained according to Higg's (2003) review.

[2] Florackis and Sainani (2018) find that U.K. CFOs are perceived to play a more important strategic role because 85% of them sit on the board of directors in their firms, while only 11% of U.S. CFOs hold board positions.

statement comparability). This suggests that CFO uncertainty avoidance background may help reduce crash risk through decreasing bad news hoarding behaviour (e.g., less opaque financial reporting). We also find that the effect of CFO uncertainty avoidance on crash risk is more pronounced when firms have higher risk (i.e., higher cash flow volatility, earnings volatility, return volatility, and expected default frequency). This suggests that CFO uncertainty avoidance background could help reduce crash risk through decreasing potential bad news (e.g., less risky investments).

Third, in robustness tests, we find that the effect of CFO uncertainty avoidance on stock price crash risk is particularly important when CFOs have a greater ability to influence firm decisions (i.e., older CFOs, and CFOs with higher relative pay). This provides further support for the importance of CFO cultural background to firms' policies and outcomes. Additionally, we find that our results hold after controlling for additional factors, including executive characteristics (age, tenure, and gender of CEOs and CFOs), financial reporting features (earnings management and accounting conservatism), corporate governance characteristics (CEO duality, board size, and proportion of independent directors), CFO equity incentives, firm internationalisation (percentage of foreign sales and percentage of foreign directors), the largest percentage of foreign CFOs (American), and the effect of foreignness (foreign CFO indicator).

This paper provides several important contributions to the extant literature. First, we add to the literature on price crash risk by identifying an additional and important determinant: CFO cultural background. This area has been underexplored in prior literature. Second, we contribute to the literature on executive characteristics and upper echelons theory by documenting that executives' cultural values, especially uncertainty avoidance, affect corporate decisions and outcomes. To the best of our knowledge, this is the first paper to investigate the relationship between cultural dimension and price crash risk at a firm level.

Third, we contribute to the previously overlooked literature on the effect of CFOs by documenting their outsize importance in corporate financial decisions and outcomes, even beyond that of CEOs. Uhde, Klarner, and Tuschke (2017) note that CFOs play an increasingly influential role at the top of firms, but relevant studies remain scarce and fragmented. We provide additional evidence about the roles of CEOs and CFOs in the U.K. (Aguilera et al., 2006; Florackis and Sainani, 2018; Keenan, 2004). Last, we extend previous cross-country cultural literature by documenting the managerial cultural effect in a novel single-country setting. This enables a better statistical identification of the relation between CFOs' cultural background and stock price crash risk by mitigating the concerns of country-level omitted factors. It also highlights a valuable implication that managerial cultural background is relevant even for managers working in the same country. Ultimately, our paper shows that CFO cultural background is a central and essential factor that should not be neglected in capital markets.

The remainder of this paper is organised as follows: Section 2 provides an overview of the relevant literature and presents our hypothesis. Section 3 discusses our data and methodology, while section 4 presents the empirical results. Section 5 concludes.

2. Literature and hypothesis development

2.1. Price crash risk

The mechanism of corporate stock price crash risk is based on the argument that managers tend to hoard negative information over an extended period, allowing it to accumulate. If managers withhold negative information successfully, the distribution of stock returns should be more negatively skewed (Callen and Fang, 2015; Chen et al., 2001; Hutton et al., 2009). However, when the stockpile of negative news reaches a certain threshold, it is released to the market all at once, leading to a sharp price decrease. The agency theoretic

framework proposed by Jin and Myers (2006) suggests that crash risk can be caused by the existence of information asymmetries between corporate insiders and external stakeholders.

Several streams of literature have investigated the potential determinants of crash risk (Habib et al., 2018). First, specific signals from capital markets, such as trading volume as investigated in Chen et al. (2001), and stock liquidity as examined in Chang et al. (2017), can predict future crash risk.

Second, crash risk is found to be closely related to the quality of the corporate governance mechanism. For example, Andreou et al. (2016) find that ownership structure, accounting opacity, board structure, and managerial incentives can explain price crash risk. Empirical studies also find that analyst coverage affects firm-specific crash risk (Xu et al., 2013; Xu et al., 2017).

Third, informal institutional mechanisms can explain future crash risk. Lee and Wang (2017) find that political connections of directors affect stock price crash risk in China. Callen and Fang (2015) document that religion affects crash risk when looking at firms headquartered in different U.S. counties.

Fourth, prior studies suggest that managers' idiosyncratic characteristics may shape their decisions on withholding bad news. For example, Kim et al. (2016b) show that CEO overconfidence is an important factor in future crash risk because overconfident CEOs are more likely to overestimate future cash flows and undertake negative net present value projects. Andreou et al. (2017) document a negative relationship between CEO age and stock price crash risk. They posit that CEOs have greater financial incentives to hoard bad news in their earlier careers. This stream of the literature is more closely related to our setting for investigating the determinants of stock price crash risk.

2.2. Chief financial officers (CFOs)

A seminal study in business and management by Dearborn and Simon (1958) recognises the importance of top managers to firms' value-generating activities. It concludes that managers exhibit comprehensive differences in attitudes, knowledge, and perspectives, stemming mainly from differences in their functional backgrounds, which can lead to widely varying strategic decisions. Hambrick and Mason (1984), building on Dearborn and Simon's (1958) work, develop the upper echelons theory, which states that the top management team's background characteristics are key predictors of organisational behaviours and outcomes. Decision-making in organisations is complicated by uncertainty, ambiguity, and competing goals. Top managers will use their cognitive biases and values to filter information, assess situations, and make strategic decisions. Bertrand and Schoar (2003) further document that top managers have statistically and economically significant effects on corporate decisions.

However, empirical studies thus far have focused primarily on the effect of CEOs, with the implicit assumption that power and key decision-making authority are concentrated in their hands (Herrmann and Datta, 2002). There has been only limited research into whether and how CFOs influence corporate decisions, although that has begun to change, with some recent studies recognising the vital role of CFOs. Ham et al. (2017), for example, note that CFOs are responsible for the accuracy and timeliness of firm financial disclosures, and therefore have the greatest share of firm financial duties. Ge et al. (2011) find that CFO fixed effects can explain a range of accounting practices, such as operating lease classifications, discretionary accruals, and earnings smoothing. More importantly, they find little evidence linking CFO fixed effects to standard demographic characteristics, such as gender, age, or education, and conclude it is likely that more subtle personality attributes are at play.

These two studies are closely tied to our research question, because the influence of CFO personality on accurate and timely information disclosures leads to variations in firms'

stock price crash risk. Therefore, our study complements both Ham et al. (2017) and Ge et al. (2011) by highlighting CFO cultural background as one of the subtle but important personal features that affect CFO financial decisions.

2.3. Cultural characteristics

An emerging literature has documented the significant influence of culture on corporate decisions and outcomes, such as analysts' forecasting accuracy, information disclosures and corresponding market responses, and firm performance under pressure. Du et al. (2017) use individual ethnicity as a proxy for culture. They find supportive evidence for the effect of cultural proximity on information asymmetry in financial markets, which highlights its importance as a component of human capital. Brochet et al. (2018) show that managers' ethnic backgrounds can affect how they communicate with investors and how the market responds to the disclosure event. Furthermore, Nguyen et al. (2018) present evidence that CEOs' cultural heritage affects U.S. bank performance under competitive pressure. They attribute the effect to the wide variety of cultural values that represent a CEO's ancestral country of origin.

Liu (2015) documents that CEO cultural origin is an economically important determinant of CEO incentives, which dominates other CEO-specific factors such as birth year, gender, education, MBA degree, selective college, and military experience. This indicates that managerial cultural background is a key feature with an incremental effect that is above and beyond other managerial characteristics.

Prior literature has also analysed the role of uncertainty avoidance in business. Kwok and Tadesse (2006) test how uncertainty avoidance affects individuals' investment preferences. Using cross-country analysis, they find that countries with stronger uncertainty avoidance tend to have a more risk-averse market-based financial system. Kanagaretnam et al. (2014) find that uncertainty avoidance affects accounting conservatism and risk-taking in the banking industry. Specifically, banks in countries with stronger uncertainty avoidance tend to be less risk-taking,

and more conservative in their earnings reports. Using a firm-level analysis, Pan et al. (2017) find that CEOs with stronger uncertainty avoidance are less likely to undertake acquisitions and R&D investments. Given the important influence of culture, especially uncertainty avoidance, in financial markets, it is worth examining whether this aspect of executives affects crash risk.

Hofstede's cultural dimensions have been widely used in multi-country cultural studies, but, in this paper, we examine a single-country setting. We thus avoid the problem of correlated omitted variables, such as economic conditions, dominant religions, legal origins, and governance quality. Previous literature (Conyon et al., 2018) has found that U.K. firms have higher proportions of foreign executives with more diverse nationalities than firms in other countries such as the U.S. Accordingly, we choose to focus on U.K. firms, and conduct our analyses of the cultural background of foreign executives directly at a firm level.

Following Kanagaretnam et al. (2014) and Pan et al. (2017), we measure uncertainty avoidance using Hofstede et al.'s (2010) UAI, which captures a society's tolerance for uncertainty and ambiguity. That is, individuals with a strong UAI will try to control the future and maintain more rigid codes of belief and behaviour. CFOs with a strong UAI may prefer to avoid future uncertainty and ambiguity for their firms. A stronger UAI would also reflect a society with stronger formalised rules and established group norms for the purpose of ensuring stability, resulting in less room for individual discretion (Mahajan and Toh, 2017; Randolph and Sashkin, 2002).

Nadler and Breuer (2017) further suggest that a culture of uncertainty avoidance may affect individual risk preference (e.g., Hens and Wang, 2007) or ambiguity preference (e.g., Chui and Kwok, 2008), or perhaps both. In other words, CFOs with stronger UAI may be more risk averse, so they may follow more conservative corporate policies with less risky projects. They may also be more ambiguity averse, and therefore more willing to reveal, and less likely

to hoard, up-to-date bad news. Both of these effects could lead to lower stock price crash risk. Thus, our hypothesis is as follows:

Hypothesis 1: Firms with CFOs who have stronger UAI will experience lower price crash risk.

3. Data and variables

3.1. Data

Our data come from three main sources. Executive characteristics and corporate governance variables are obtained from BoardEx (any missing executive nationality is manually collected from FAME). Firm-level data, including return index, firm revenues, and accounting data, are derived from Datastream. UAI is obtained from Hofstede et al. (2010).

The sample consists of the constituents of the FTSE All-Share Index during the 1999-2015 period. This index captures 98% of the U.K.'s market capitalisation, and is comprised of all the constituents of the FTSE 100, the FTSE 250, and the FTSE Small Cap Indexes. We collect the return index on these firms from Datastream, and calculate weekly stock returns for all individual firms. We follow Ince and Porter (2006) and An et al. (2018) in screening and correcting the return index. In particular, we set a return index as missing if it is less than 0.01, and we exclude the observation if the return index exceeds 200% and reverses in one week. We truncate the absolute value of unusually high weekly returns at 0.5.

We then filter the sample by: 1) winsorising the firm-level variables at the 1st and 99th percentiles in order to eliminate potential outlier effects, and 2) excluding any firms with less than 26 weekly observations in a given year. The final sample consists of 703 firms, 1,340 CFOs, and 6,351 firm-years, and contains 106 unique foreign CFOs (426 firm-years with non-U.K. CFOs) from 17 countries. Table 1 shows that the CFOs with the strongest and weakest UAI are from France (0.86) and Singapore (0.08), respectively.

[Insert Table 1 here]

3.2. Model specification

To investigate whether CFO UAI affects future stock price crash risk, we use the following pooled OLS regression model in our empirical analyses:[3]

$$CRASH\_RISK_{i,t} = \alpha + \beta \times CFO\_UAI_{i,t-1} + \sum_{k=1}^{K} \gamma_k \times CONTROL_{i,t-1}^{k} + \epsilon_{i,t} \quad (1)$$

where $CRASH\_RISK$ is measured by the variables $COUNT$, $NCSKEW$, and $DUVOL$, which we elaborate on in the next subsection. CFO_UAI is determined by the nationality of the CFO. Following prior literature, $CONTROL$ includes control variables on investor belief heterogeneity, stock historical performance, and firm characteristics. Definitions of the main variables are in Appendix A. A set of year time dummies is included to capture the effects of macroeconomic shocks, and a set of industry dummies is included to capture interindustry differences in the demand for executive talent. In addition, we apply lead-lag regressions to reduce issues related to reverse causality.

3.3. Stock price crash risk

To measure stock price crash risk, we follow Hutton et al. (2009) and Kim et al. (2011). We use weekly returns within one fiscal year for each firm to estimate firm-specific weekly returns. First, we estimate the following regression model:

$$r_{i,t} = \alpha_i + \beta_{1i} r_{m,t-2} + \beta_{2i} r_{m,t-1} + \beta_{3i} r_{m,t} + \beta_{4i} r_{m,t+1} + \beta_{5i} r_{m,t+2} + \varepsilon_{it} \quad (2)$$

where $r_{i,t}$ is the return on an individual stock i in week t, and $r_{m,t}$ is the return on the FTSE All-Share Index in week t. Lead and lag returns for the market are included to allow for non-

[3] We also test for the likelihood of a quadratic relation between CFO UAI and crash risk by simultaneously including CFO_UAI and its square in the same regression. Corresponding results are shown in Table A1 in the Online Appendix. From these results, we find no evidence of a quadratic relation, since both the coefficient on CFO_UAI and the coefficient on its square are statistically insignificant. It is thus more likely that CFO_UAI will linearly affect stock price crash risk, but unlikely that a CFO will have a retroactive influence on crash risk due to having a cultural background that overemphasises UAI.

synchronous trading (Dimson, 1979). The residual term from the above regression model is used to calculate firm-specific weekly returns (W_{it}):

$$W_{i,t} = \ln(1 + \varepsilon_{i,t}) \quad (3)$$

We use three measures to proxy for stock price crash risk. The first, $COUNT$, is based on the number of firm-specific weekly returns exceeding 3.20 standard deviations above and below the mean firm-specific weekly return over the fiscal year, taking the downside minus the upside frequencies.

The second, $NCSKEW$, is the negative skewness of firm-specific weekly returns, and is calculated by dividing the negative of the third moment of the firm-specific weekly returns in a fiscal year by the standard deviation of those returns raised to the third power:

$$NCSKEW = -\frac{N(N-1)^{\frac{3}{2}}\sum W_{i,t}^3}{(N-1)(N-2)\left(\sum W_{i,t}^2\right)^{\frac{3}{2}}} \quad (4)$$

where N is the number of firm-specific weekly returns of firm i in a fiscal year.

The third, $DUVOL$, measures the down-to-up volatility of firm-specific weekly returns by dividing all the weeks in a fiscal year into two groups: down-weeks with firm-specific weekly returns below the annual mean, and up-weeks with firm-specific weekly returns above the annual mean. $DUVOL$ is then calculated as the natural logarithm of the ratio of the standard deviation of firm-specific weekly returns in down-weeks to that in up-weeks, as follows:

$$DUVOL = \ln\left(\frac{(N_U - 1)\sum W_{i_D,t}^2}{(N_D - 1)\sum W_{i_U,t}^2}\right) \quad (5)$$

where $W_{i_D,t}/W_{i_U,t}$ is firm i's firm-specific weekly return in a down-/up-week, and N_D/N_U is the number of down-/up-weeks in a fiscal year.

All three proxies provide indications of the asymmetry of firm-specific weekly returns. Higher values of $COUNT$, $NCSKEW$, and $DUVOL$ indicate higher levels of crash risk.

3.4. CFO uncertainty avoidance background

To measure CFO uncertainty avoidance background, we follow prior literature (e.g., Kanagaretnam et al., 2014), and use the uncertainty avoidance index from Hofstede's cultural dimensions to assign scores based on CFO nationality. As we noted earlier, we obtain CFO nationality data from BoardEx, and we manually collect any missing data from FAME.

One caveat is that our empirical measure of CFO cultural background depends on nationality, which is prone to measurement error. For example, CFO nationality may differ from CFO birth country. We therefore test the validity of our measure by comparing our nationality measure to the manually collected CFO birthplace information from "Ancestry.com" for a subsample of FTSE 350 firms across our sample period. We are able to find the birthplace for 68% of CFOs for FTSE 350 firms. Among these, only 3% had a different nationality from birth country, indicating that our nationality measure is largely accurate. Using birthplace leads to a huge loss in available observations, but CFO nationality matches birthplace in most cases. Therefore, we believe the nationality measure is the best available measure to capture CFO cultural background.

3.5. Control variables

Following prior research on price crash risk (Andreou et al., 2016; Chen et al., 2001; DeFond et al., 2015; Hutton et al., 2009; Kim et al., 2011; Kim et al., 2016a), we include the following control variables in regression models. To control for investor belief heterogeneity, we include the detrended stock trading volume ($\Delta TURN$) to measure difference of opinion among investors. To control for the potential persistence of the third moment of stock returns, and address concerns about dynamic endogeneity, we use the lag value of the negative skewness of past firm-specific stock returns ($NCSKEW$). Given that stocks with higher past returns and higher volatilities have a higher potential of experiencing crashes, we include the average and the standard deviation of firm-specific weekly returns (RET and STD_RET) over

the previous year in the regression. We also control for various firm fundamental characteristics: firm size ($SIZE$), which is the natural logarithm of a firm's market capitalisation; market-to-book ratio (MTB); financial leverage (LEV), which is the ratio of long-term debt to total assets; and return on assets (ROA).

4. Empirical results

4.1. Descriptive summary

Table 2, panel A, presents the descriptive statistics of the main variables in our study. The mean values of $COUNT$, $NCSKEW$, and $DUVOL$ are −0.049, −0.048, and −0.057, respectively, which are similar to those found in prior price crash risk studies (e.g., Chen et al., 2017). The firm-level characteristics are also consistent with those in prior studies based on the U.K. market (e.g., Conyon et al., 2018).

[Insert Table 2 here]

Table 2, panel B, shows the correlation matrix. All three proxies of price crash risk are highly positively correlated, confirming that they are able to capture the most common aspects.

Figure 1 presents the initial evidence for how different proxies of price crash risk change around the CFO turnover event. Panel A shows that, if the incoming CFO has a stronger UAI than the incumbent CFO, crash risk will generally decrease after the turnover. Consistently, panel B shows that a firm will suffer higher crash risk if the incoming CFO has a weaker UAI than the incumbent CFO. Both panels indicate that stronger CFO UAI is associated with lower price crash risk, supporting our hypothesis. In the next subsection, we investigate how CFO UAI affects future stock price crash risk through regression models.

[Insert Figure 1 here]

4.2. Main results

Table 3 presents the OLS regression results of stock price crash risk on CFO UAI. We use $COUNT$, $NCSKEW$, and $DUVOL$ as dependent variables in columns (1) to (3), respectively. The results reveal that stronger CFO_UAI is associated with lower future stock price crash risk.[4]

To elaborate, in model 1, the coefficient on CFO_UAI is −0.329, with a t-statistic of −2.51. With respect to economic significance, the effect of a one standard deviation (0.049) increase in CFO_UAI leads to a $0.329 \times 0.049 = 0.016$ decrease in $COUNT$. In model 2, the coefficient on CFO_UAI is −0.504 with a t-statistic of −2.85, indicating that, on average, increasing CFO_UAI by one standard deviation (0.049) will decrease $NCSKEW$ by $0.504 \times 0.049 = 0.024$. In model 3, the coefficient on CFO_UAI is −0.350 with a t-statistic of −3.12. This indicates that a one standard deviation increase in CFO_UAI leads to a decrease in $DUVOL$ of $0.350 \times 0.049 = 0.017$. Taken together, firms with CFOs who have stronger UAI experience lower crash risk in the following year, which is consistent with our hypothesis.

[Insert Table 3 here]

4.3. CEOs' and board of directors' cultural backgrounds

Thus far, our empirical results confirm that CFOs play an important role in corporate decisions and outcomes. However, previous literature has suggested that CEO characteristics significantly influence price crash risk. For example, Kim et al. (2016b) note that overconfident CEOs positively affect stock price crash risk. Andreou et al. (2017) find that CEO age is negatively related to future price crash risk. In addition, we consider the board of directors' cultural backgrounds, because previous literature has shown that board characteristics can affect firm outcomes (e.g., Erhardt et al., 2003; Haniffa and Cooke, 2005; Walt and Ingley,

[4] Results are qualitatively consistent if we focus instead on a small sample of firms with only non-U.K. CFOs (426 year-firm observations).

2003). Therefore, it is crucial to investigate whether the cultural background of CEOs or the board has a similar impact, and whether the effect of CFOs' uncertainty avoidance tendency is incremental to that of CEOs and boards.

Columns (1) to (3) of Table 4 present our regression results by including CFO_UAI, CEO_UAI, and $BOARD\_UAI$ in the same regression model.[5] The results reveal that the effect of CFO_UAI on different measures of stock price crash risk remains significant (at least at a 5% level) after taking CEO_UAI and $BOARD\_UAI$ into consideration. We fail to find any significant relation between CEO_UAI and stock price crash risk, and we only detect a marginal relation between $BOARD\_UAI$ and stock price crash risk (significant at a 10% level only in column (3)). Overall, CFO_UAI dominates CEO_UAI and $BOARD\_UAI$ in affecting stock price crash risk. The insignificant influence of CEOs on financial outcomes in U.K. firms may be attributable to the fact that they tend to be less powerful in U.K. than in U.S. firms (Keenan, 2004; Aguilera et al., 2006). Furthermore, the finding that CFOs play a more important role than CEOs in finance-related decisions is consistent with Kim et al. (2011) and Florackis and Sainani (2018).

[Insert Table 4 here]

4.4. Endogeneity

While the OLS regression assumes that the presence of a CFO with a specific cultural background is exogenous, we are concerned that it may be endogenous and influenced by the omission of relevant variables or a selection bias. For example, a CFO with a stronger UAI may be attractive to various firms. To address this concern, we first employ firm-fixed effects.

[5] Our main results hold even if we also control for: 1) the UAI difference between CFO and CEO, as well as between CFO and the board, which is defined as the absolute difference between their UAI scores; 2) the cultural background distance between CFO and CEO, as well as between CFO and the board, which is defined following Aybar and Ficici's (2009) method. Specifically, we first calculate the absolute difference between CFO and the CEO/board for four cultural dimensions (uncertainty avoidance, power distance, individualism, and masculinity). We then calculate the average ranking of each dimension divided by the number of observations in order to capture culture distance. Regression results are presented in Table A2 in the Online Appendix.

The application of firm-fixed effects controls to some extent for any unobserved, time-invariant firm-specific factors. It also allows us to test our first hypothesis via within-firm variation, e.g., when firms experience a CFO turnover between individuals with different uncertainty avoidance tendencies. The results are in Table 5, panel A, and suggest that the effect of CFO_UAI on price crash risk remains significant after controlling for firm-fixed effects.[6]

[Insert Table 5 here]

Second, we employ a difference-in-differences (DID) specification that uses a CFO turnover event. Specifically, we compare firms that are influenced by turnover events with a change in CFO UAI (the treatment group) with those without such changes (the control group). We then examine the effect of CFO turnover events. In addition, since we investigate how crash risk changes from the periods before CFO turnover to the periods afterward, we are able to control for time-invariant unobservable firm effects. Hence, we can rule out alternative explanations if no other change, independent of the CFO turnover, occurred within the firm at the same time. Note that, although the DID specification enjoys the above identification advantages, some limitations remain, such as a lower number of observations (i.e., only turnover-related firm-years are included), and a lower variation in our variable of interest (i.e., we convert our continuous CFO_UAI variable into dummy variables that capture whether an incoming CFO has stronger or weaker UAI). The DID and firm-fixed effects model therefore complement each other.

Following Huang and Kisgen (2013), we then reconstruct our sample and turnover indicators to mitigate any potential measurement errors. First, we limit our sample to the three years before and after a CFO turnover, excluding the transition year. Second, we require firm have at least two years' of available data before the CFO turnover. Third, we require that a new

[6] It is possible that CFOs may be "sticky" to firms. In such cases, the firm-fixed effects will absorb the time-invariant CFO-level characteristics. Hence, CFO stickiness will not affect our inferences, because we still find significant results.

CFO be in power for at least two years after the turnover year. The final sample consists of 614 turnovers, of which 33 involved an incumbent CFO being replaced by a new CFO with a stronger UAI, and 20 involved being replaced by a new CFO with a weaker UAI. Our difference-in-differences regression model is:

$$CRASH\_RISK_{i,t} = \alpha + \beta_0 \times POST_{i,t} + \beta_1 \times POST_{i,t} \times CFO\_DOWN_{i,t} + \beta_2 \times POST_{i,t} \times CFO\_UP_{i,t} + \sum_{k=1}^{K} \gamma_k \times CONTROL_{i,t-1}^{k} + \epsilon_{i,t} \quad (6)$$

where $POST_{i,t}$ is an indicator that equals 1 if the observation is a post-turnover event, and 0 otherwise, $CFO\_DOWN_{i,t}$ equals 1 if an incoming CFO has a weaker UAI, and 0 otherwise, and $CFO\_UP_{i,t}$ equals 1 if an incoming CFO has a stronger UAI, and 0 otherwise. We also control for firm- and year-fixed effects.

Table 5, panel B, presents corresponding results. We find that the coefficients of the interaction term $POST_{i,t} \times CFO\_DOWN_{i,t}$ are positively but insignificantly associated with crash risk, while the coefficients of $POST_{i,t} \times CFO\_UP_{i,t}$ are negatively and significantly associated with crash risk. This indicates that a new CEO with a stronger UAI will reduce firm stock price crash risk. The results are, in general, consistent with our main inferences.

Finally, we complement the above two tests by using the propensity score matching approach. The purpose is to match a set of control firms (firms that retain CFOs with median to low UAI) to a set of treatment firms (firms that retain CFOs with above-median UAI), so that the two sets are statistically alike in terms of other relevant factors. The propensity method therefore allows us to identify the treatment effect on firms. We capture the treatment firms by using an indicator variable (i.e., $HCFO\_UAI$) that equals 1 if the firms retain CFOs with above-

industry median UAIs, and 0 otherwise. Because most of the CFOs are British, median UAI is the British UAI,[7] and we only identify 268 firm-years as treated firms.[8]

Propensity score matching proceeds in two steps. In the first step, we estimate a logit model to determine the propensity score. The covariates used to predict the probability of treated firms ($HCFO\_UAI$) are consistent with the control variables used in the baseline results in Table 3. An untabulated logit regression suggests that most of the firm-level covariates predict the probability of treated firms (i.e., STD_RET, RET, $\Delta TURN$, $SIZE$, M/B, LEV). This finding confirms that the presence of CFOs with strong UAI is endogenous to these observable covariates.[9]

In the second step, we match firms by using a nearest neighbour algorithm with caliper 0.01 and no replacement, and we restrict the observations to only those within the common support. We identify 256 pairs in total. We then re-estimate our baseline regression model using a paired sample. The sample variation dramatically decreases because of both the limited observations of CFOs with above-median UAI, and the transformation of UAI from continuous values (ranging from 0.08 for Singapore to 0.86 for France) to an indicator value (0 and 1). Nevertheless, Table 5, panel C, reveals a marginally significant and negative relation between CFO UAI and $COUNT$ and $NCSKEW$.

Collectively, the results from firm-fixed effects regressions, the difference-in-differences specification, and propensity score matching estimators are consistent with our baseline results. Therefore, the negative effect of CFO_UAI on future stock price crash risk is robust after controlling for correlated omitted variables and selection bias.

[7] Because of the cross-industry heterogeneity, we apply an industry median as a benchmark to determine $HCFO\_UAI$. Untabulated results show our results remain robust if we use the sample median instead.

[8] The treatment firms are those with CFOs from Australia, Brazil, Canada, Netherlands, France, Germany, India, Israel, Italy, Malaysia, New Zealand, Norway, South Africa, Switzerland, and the U.S.

[9] Due to space limitations, we do not report the logit regression for the first step of the propensity score matching approach. However, the results are available upon request.

4.5. Additional analyses

In this section, we explore the potential channels through which CFO uncertainty avoidance background affects future stock price crash risk.

4.5.1. The effect of information asymmetry

First, we investigate whether the negative relationship between CFO uncertainty avoidance and future stock price crash risk is affected by the level of a firm's asymmetric information. The agency theoretic framework suggests that crash risk results from managerial bad news hoarding behaviours (Jin and Myers, 2006; Hutton et al., 2009). The uncertainty avoidance culture influences individuals' ambiguity preferences (Chui and Kwok, 2008). Given these notions, we expect that managers' abilities and incentives to hoard bad news will be stronger in firms with higher information asymmetry.

Empirically, we divide our sample into two groups based on four different measures to gauge the level of information asymmetry. First, we use number of analysts following, $Analyst\ coverage$, as a proxy for the strength of a firm's external monitoring. A higher number of analysts following indicates stronger external monitoring. Yu (2008) documents that firms with higher levels of analyst following tend to engage in less opportunistic earnings management, indicating that managerial discretionary behaviour is constrained by stronger external monitoring. Accordingly, we expect that the negative effect of CFO UAI on price crash risk will be stronger for firms with a weaker external monitoring environment. The subsample results are in Table 6, panel A. We find that the negative effect of CFO UAI is more significant for firms with a lower number of analysts following, consistent with our expectation.

[Insert Table 6 here]

Second, we use bid-ask spreads as a proxy for the quality of a firm's information environment. $Bid - ask\ spread$ is the annual average spread calculated using the daily ratio of the difference between the ask and bid prices to the midpoint of the ask and bid prices. A

higher bid-ask spread indicates a lower level of information environment quality. Jayaraman (2008) suggests that higher bid-ask spreads could be due to higher levels of informed trading. We expect that the effect of CFO UAI will be stronger for firms with lower levels of information environment quality. The results are in Table 6, panel B. We find that the negative effect of CFO UAI on price crash risk is stronger for firms with higher bid-ask spreads, consistent with our expectation.

Third, we use financial statement comparability as a proxy for the quantity and quality of a firm's information. $Financial\ statement\ comparability$ denotes firm-level comparability as developed by De Franco et al. (2011). It is calculated as the average of the four highest comparability scores for all i-j firm pairs in the same industry during period t.[10] Prior literature suggests that comparability lowers the cost of acquiring and processing information and enhances the quality of information available to investors (De Franco et al., 2011; Kim et al., 2016a). We expect the effect of CFO UAI to be stronger when firms' financial statements are less comparable. The results are in Table 6, panel C. We find that the effect of CFO UAI is more pronounced for firms with lower financial statement comparability, consistent with our expectation.

Overall, the results in Table 6 are consistent with our expectation that the effect of CFO UAI is stronger among firms with a higher level of information asymmetry.

4.5.2. The effect of firm risk

Second, we investigate whether the negative association between CFO uncertainty avoidance and future stock price crash risk is affected by the riskiness of the firm. Prior literature argues that the culture of uncertainty avoidance influences individual risk preferences.

[10] Untabulated results show that our inferences are robust to an alternative financial statement comparability measurement, which is calculated as the median of the comparability scores for all i-j firm pairs in the same industry during period t.

That is, CFOs with stronger UAI may be more risk averse and follow more conservative corporate policies with less risky projects, resulting in less bad news to hoard. Accordingly, we expect that managers' risk aversion due to a strong uncertainty avoidance background will be stronger in firms with more risk-taking activities (i.e., riskier firms).

Empirically, we divide our sample into two groups based on four measures to proxy for firm riskiness: $Cash\ flow\ volatility$ is the standard deviation of quarterly cash flows from operations over the sixteen quarters scaled by total debt (Graham et al., 2008); $earnings\ volatility$ is the standard deviation of the past eight earnings changes scaled by the average book asset over the past eight quarters (Valta, 2012); $return\ volatility$ is annualised volatility calculated using monthly stock returns from the previous year (Bharath and Shumway, 2008; Brogaard et al., 2017); and $expected\ default\ frequency$ is the probability that the value of a firm's assets will be less than the face value of its debt (Bharath and Shumway, 2008; Brogaard et al., 2017).

The results are in Table 7, panels A-D. We find strong evidence that the effect of CFO UAI is more pronounced for firms with higher levels of cash flow volatility, earnings volatility, return volatility, and expected default frequency. Collectively, the results in Table 7 are consistent with our expectation that the effect of CFO UAI is stronger for firms with higher levels of riskiness.

[Insert Table 7 here]

4.6. Robustness Tests

4.6.1. The effect of CFO influence

In this subsection, to further confirm the important role of CFO cultural background in affecting corporate decision and outcomes, we explore whether the negative association between CFO uncertainty avoidance and future stock price crash risk is affected by the level of influence of CFOs on firm decision-making. The underlying premise is that executives can

only affect firm outcomes when they have a solid influence on firm decisions (Adams et al., 2005). Specifically, we test two measurements of CFOs' ability to influence firm decisions: CFO seniority, and CFO relative pay.

First, we examine whether the effect of CFO UAI on price crash risk is subject to CFO seniority. In order to affect a firm's financial strategy and financial information disclosure, CFOs must have sufficient capabilities, experiences, and confidence. Professional skills accumulate over time, and these skills are more likely to be better developed in senior CFOs (Florackis and Sainani, 2018). In other words, CFO seniority is closely related to CFOs' level of professional skills, and it also captures how a CFO can affect a firm's financial strategy and information disclosure. Therefore, we expect that the effect of CFO UAI will be stronger when CFOs are more senior.

We separate our sample into two subsamples based on CFO age, and test how CFO seniority interacts with CFO UAI. The results are in Table 8, panel A. We find that the coefficients on CFO UAI on price crash risk are significant, with higher economic magnitude, only in firms with more senior CFOs. This is consistent with our expectation.

[Insert Table 8 here]

Second, we examine whether the effect of CFO UAI on price crash risk is subject to CFO relative pay. As suggested in Finkelstein (1992), a manager's compensation is an important measure of influence within a firm. Thus, more highly paid CFOs are expected to have a more significant effect on corporate decisions. To capture the potential influence of a CFO on corporate financial strategy, we use CFO relative pay, which is defined as the ratio of the CFO's total compensation, excluding equity-based awards, to the CEO's total compensation. If CFO relative pay is higher, we expect that the CFO uncertainty avoidance tendency will be more likely to influence a firm's financial reporting decisions, and, therefore, the stock price crash risk.

We divide our sample into two groups based on CFO relative pay. The results are in Table 8, panel B. We find that the negative effect of CFO UAI on price crash risk is stronger when CFO relative pay is higher, especially for $COUNT$ and $NCSKEW$, which is consistent with our expectation. Taken together, the above analyses indicate that the effect of CFO UAI on stock price crash risk is particularly important when CFOs are likely to have a greater influence on firm decisions.

4.6.2. Additional controls

At last, to further ensure robustness, we re-estimate our main regression models with a full set of control variables, and then control for additional factors.[11] First, we consider other executive characteristics, including age, tenure, and gender of CEOs and CFOs. Andreou et al. (2017) document that firms with younger CEOs are more likely to experience stock price crash risk, since CEOs have more incentives to hoard bad news in their earlier careers. The relevant results are presented in Table 9, panel A.

[Insert Table 9 here]

Second, we consider financial reporting quality. Hutton et al. (2009) find that the transparency of financial statements affects stock price crashes. This is because higher financial reporting quality can help reduce information asymmetry. Specifically, they find a non-linear effect of financial reporting opacity on crash risk. Kim and Zhang (2016) also document that conditional conservatism can reduce managers' incentives and ability to hide bad news. It is therefore associated with a lower crash risk. Thus, we control for accounting quality by including $OPAQUE$ and its square, as well as a conservatism score, in addition to our main results.[12] The relevant results are in Table 9, panel B.

[11] The number of sample observations varies depending on the data availability of additional controls.

[12] Our primary measure for opacity captures performance-adjusted discretionary accruals, as developed by Kothari et al. (2005). Our results are not sensitive if we measure discretionary accruals with a modified Jones model (Dechow et al., 1995) (as shown in Table A3 in the Online Appendix).

Third, we consider corporate governance characteristics. Higher corporate governance quality reflects more effective monitoring over executives. Because high governance quality may prevent executives from hoarding bad news, it leads to a limited effect of CFOs on future crash risk. Therefore, we investigate whether corporate governance quality affects the influence of CFO UAI on stock price crash risk. We use three proxies for corporate governance characteristics: board size, CEO-chairman duality, and non-executive director ratio (i.e., proportion of independent directors). The relevant results are in Table 9, panel C.

Fourth, we consider CFO equity incentives. Equity incentives may induce managerial short-termism, such as bad news hoarding, by inflating short-term stock prices (Bolton et al., 2006; Benmelech et al., 2010). Kim et al. (2011) find that executives' (especially CFOs') equity incentives significantly affect crash risk. Therefore, we control for CFO equity incentives, which are measured as the ratio of equity-based incentives over total compensation.[13] The relevant results are in Table 9, panel D.

Fifth, we consider Hofstede's other cultural dimensions, besides uncertainty avoidance. These include power distance, PDI (the extent to which less powerful members of organisations and institutions accept and expect power to be distributed unequally), individualism, IDV (the extent to which people feel independent, as opposed to being interdependent members of larger wholes), and masculinity, MAS (the extent to which the use of force is endorsed socially). Previous literature finds that other cultural dimensions, especially individualism, are also pertinent for information disclosure and financial outcomes. For example, Kanagaretnam et al. (2014) find that individualism is negatively related to accounting conservatism, and positively related to risk-taking in the banking industry. An et al. (2018) and Dang et al. (2018) find that firms located in countries with higher levels of

[13] We also consider an alternative CFO equity incentives measurement: the natural logarithm of equity-based compensation. Corresponding results are presented in Table A4 in the Online Appendix, and show that our inferences are robust to this alternative measure.

individualism have higher stock price crash risk. Jakob and Nam (2017) show that higher masculinity and individualism are significantly associated with less negative abnormal market reactions prior to official sovereign debt rating downgrade announcements. The relevant results are in Table 9, panel E.[14]

Sixth, we consider firm-level internationalisation. As it increases, the level of complexity and monitoring difficulty also increase. This leads to higher asymmetric information and agency problems. Boehme and May (2016) find that multinational firms are more likely to crash. Hence, we include two proxies for firm internationalisation: percentage of foreign sales, and percentage of foreign directors.[15] The relevant results are in Table 9, panel F.

Seventh, we consider whether our finding on the effect of CFO UAI is driven by a specific group of CFOs. Table 1 shows that U.S. CFOs make up the third-highest proportion, after U.K. and Irish CFOs. We therefore test whether our results hold by including a dummy variable, CFO_USA, which equals 1 if a CFO's nationality is American, and 0 otherwise. The results are in Table 9, panel G.

Last, we consider the effect of foreignness. One could argue that the CFO effect is due purely to foreignness rather than to cultural background. We therefore test whether our results hold when we include a dummy variable that equals 1 if a CFO is not British, and 0 otherwise. The relevant results are in Table 9, panel H.

[14] We note that CFO_UAI is highly correlated with CFO_PDI (0.662), CFO_IDV (-0.394), and CFO_MAS (-0.588) (as shown in Table A5 in the Online Appendix). High correlations may cause multicollinearity in our analysis. We therefore test the variance inflation factors (VIFs) of these cultural dimensions to check for multicollinearity. The VIFs are low, and below the threshold of 10 (Hair et al., 2009), indicating that multicollinearity is unlikely to be a major concern in our regressions. In addition, we orthogonalize CFO_UAI by regressing CFO_UAI on the other cultural dimensions (i.e., CFO_PDI, CFO_IDV, CFO_MAS) and taking the residual (CFO_UAI_RE). CFO_UAI_RE captures the component of UAI that cannot be explained by the other Hofstede cultural dimensions. We re-estimate our baseline modules and find that our main inferences hold. Details for corresponding results are shown in Table A6 in the Online Appendix.

[15] Our results are also robust when using alternative measures of firm internationalisation, including percentage of foreign assets, percentage of foreign income, and number of geographic segments (international diversification). Corresponding results are available upon request.

Based on Table 9, we find that CFO_UAI continues to have a significant effect even after considering these additional variables. This provides further confirmation of the robustness of our main results.

5. Conclusion

This paper investigates the relation between the cultural background of CFOs and the risk of future stock price crashes. Consistent with the conjecture that individuals with strong UAI prefer certainty over ambiguity, we find that firms with CFOs who have stronger UAI experience lower future stock price crash risk. This significant and negative impact dominates even the effect of CEOs' and the board's UAI. The results are robust to controlling for potential endogeneity by applying firm-fixed effect regressions, a difference-in-differences specification, and a propensity score matching procedure. Additional analyses further suggest that the effect of CFO UAI is stronger when firms have higher information asymmetry, and when firms are riskier. Finally, robustness tests highlight that the role of CFO UAI is more pronounced when the CFO is more likely to strongly influence firm decisions. We also find that the effect of CFO UAI on stock price crash risk remains after controlling for other executive characteristics (i.e., age, tenure, and gender), financial reporting quality, corporate governance quality, CFO equity incentives, other cultural dimensions (i.e., power distance, individualism, and masculinity), and foreignness of CFOs.

This paper provides valuable implications for both scholars and practitioners. First, in addition to firm fundamental features, we suggest that managerial cultural background provides capital market participants with subtle but important information in evaluating firms and making investment decisions. More importantly, we find that cultural dimension affects not only managerial behaviour across countries, as suggested by prior literature, but also managers with different backgrounds but who work in the same country. Second, this paper highlights

the importance of linking specific executives to specific firm aspects. In particular, we highlight the importance of CFOs in affecting corporate extreme downside risk, which is an outcome of high importance to capital market participants.

In summary, this paper presents consistent results that CFO cultural background, especially the uncertainty avoidance tendency, has a significant influence on firm decisions and outcomes. By going beyond the effect of CEO and board characteristics examined in prior research, this study encourages capital market participants to also consider vital CFO characteristics when making investment decisions.

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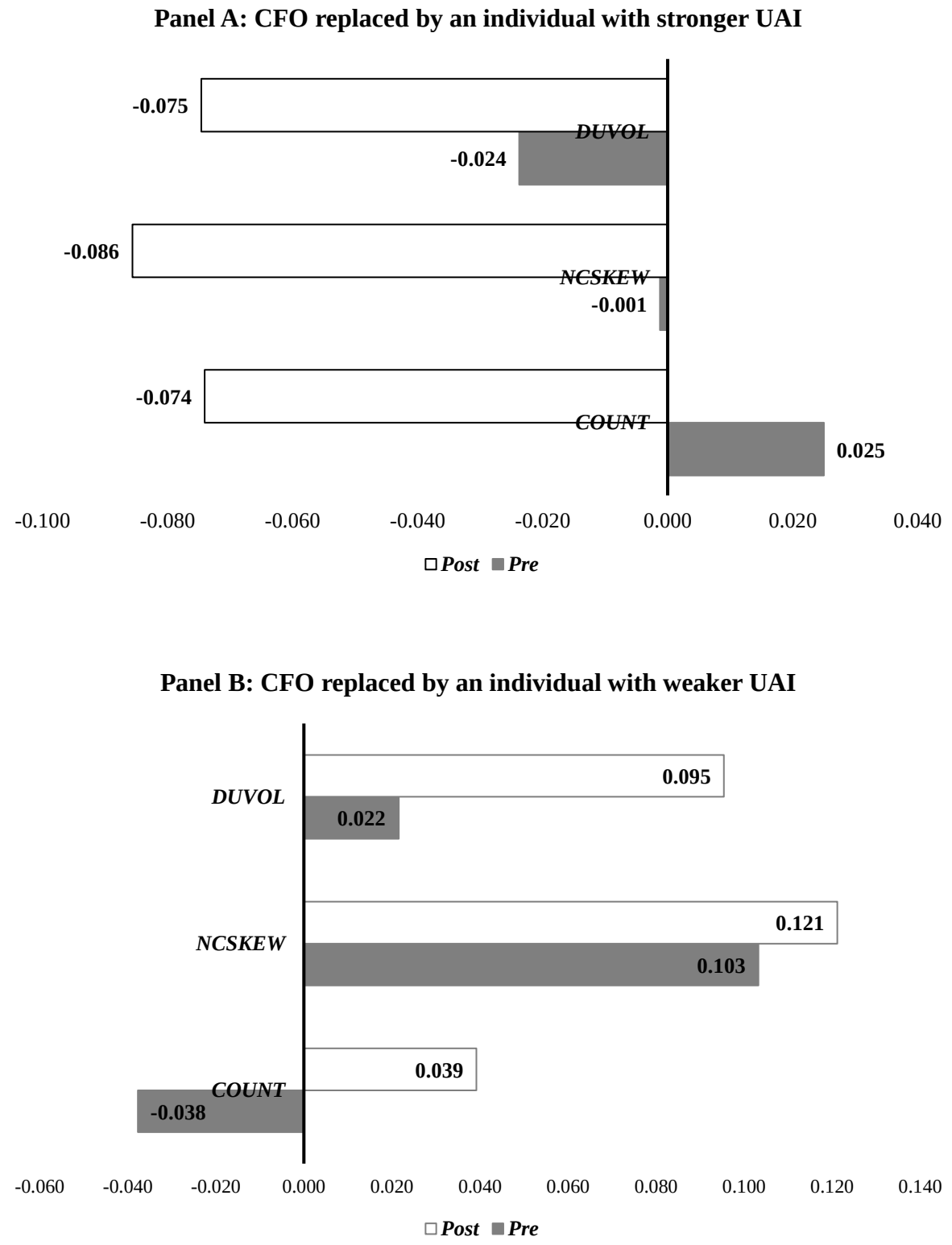
Appendix A: Variable definitions

Variable	Definition
Dependent variables: Price crash risk measures	
$COUNT$	The difference between the number of firm-specific weekly returns exceeding 3.20 standard deviations below the mean firm-specific weekly return over the fiscal year, and the number of firm-specific weekly returns exceeding 3.20 standard deviations above the mean firm-specific weekly return.
$NCSKEW$	The negative skewness of firm-specific weekly returns during the fiscal year period.
$DUOVL$	The natural logarithm of the ratio of the standard deviation of firm-specific weekly returns for down-weeks to that for up-weeks. For a firm over a fiscal year period, down-weeks are defined as all weeks with firm-specific weekly returns below the annual mean, and up-weeks are all weeks with firm-specific weekly returns above the annual mean.
Test variables: CFO cultural background	
CFO_UAI	Country-level Hofstede uncertainty avoidance index according to CFO nationality.
Control variables	
$\Delta TURN$	The change in average monthly stock turnover compared to the previous fiscal year. Monthly stock turnover is defined as the ratio of monthly trading volume to average number of shares outstanding.
RET	The mean of firm-specific weekly returns during one fiscal year.
STD_RET	The standard deviation of firm-specific weekly returns during one fiscal year.
$SIZE$	The natural logarithm of a firm's market capitalisation at the end of one fiscal year.
M/B	The ratio of the market value of equity to book value.
LEV	The ratio of long-term debt to total assets.
ROA	The return on assets, which is the ratio of income before extraordinary items to closing total assets.
Additional control variables	
CEO_UAI	Country-level Hofstede uncertainty avoidance index according to CEO nationality.
$BOARD\_UAI$	The average UAI of board members, excluding the CEO and the CFO.
CEO_AGE	Age of CEO.
CEO_TENURE	Tenure of CEO.
CEO_GENDER	An indicator variable that equals 1 if a CEO is female, and 0 otherwise.
CFO_AGE	Age of CFO.
CFO_TENURE	Tenure of CFO.
CFO_GENDER	An indicator variable that equals 1 if a CFO is female, and 0 otherwise.

$OPAQUE$	The previous three years' moving sum of the absolute value of annual performance-adjusted discretionary accruals, where the discretionary accruals are estimated following Kothari et al. (2005).
$OPAQUE^2$	The square of $OPAQUE$.
C_SCORE	The conservatism score estimated following Khan and Watts (2009).
$BOARD\_SIZE$	The total number of directors on a firm's board.
$DUALITY$	An indicator variable that equals 1 if the CEO is the chairman, and 0 otherwise.
NED_RATIO	The proportion of non-executive directors.
$EQUITY\_INCENTIVE$	The ratio of equity-based incentives over total compensation.
CFO_PDI	Country-level Hofstede power distance index according to CFO nationality.
CFO_IDV	Country-level Hofstede individualism index according to CFO nationality.
CFO_MAS	Country-level Hofstede masculinity index according to CFO nationality.
$FOREIGN\_SALES$	The percentage of foreign sales of a firm.
$BOARD\_FOREIGN$	The percentage of non-British directors on a firm's board.
CFO_USA	An indicator variable that equals 1 if a CFO is American, and 0 otherwise.
$CFO\_FOREIGN$	An indicator variable that equals 1 if a CFO is not British, and 0 otherwise.

Figure 1. CFO turnover and stock price crash risk



Notes: Figure 1 presents the average price crash risk around the CFO turnover event. The sample consists of firm year observations three years pre- and post CFO turnover event, excluding the event year. For both Panel A and Panel B, the vertical axis represents three different measures of price crash risk, whereas the horizontal axis represents the corresponding average values of price crash risk.

Table 1. CFO nationality distribution

Nationality	Freq.	Percent	Cum.	UAI
American	97	1.53	1.53	0.46
Australian	35	0.55	2.08	0.51
Brazilian	2	0.03	2.11	0.76
British	5,925	93.29	95.4	0.35
Canadian	6	0.09	95.5	0.48
Dutch	11	0.17	95.67	0.53
French	40	0.63	96.3	0.86
German	1	0.02	96.32	0.65
Indian	1	0.02	96.33	0.40
Irish	151	2.38	98.71	0.35
Israeli	2	0.03	98.74	0.81
Italian	1	0.02	98.76	0.75
Malaysian	3	0.05	98.8	0.36
New Zealander	14	0.22	99.02	0.49
Norwegian	4	0.06	99.09	0.50
Singaporean	2	0.03	99.12	0.08
South African	49	0.77	99.89	0.49
Swedish	5	0.08	99.97	0.29
Swiss	2	0.03	100	0.58
Total	**6,351**	**100**		

Notes: Table 1 presents the distribution of CFO nationality, including frequency, percentage, and UAI, for FTSE All-Share firms from 1999 to 2015.

Table 2. Summary Statistics

Panel A: Descriptive Statistics

Variable	Number	Mean	Std Dev	P25	Median	P75
$COUNT$	6351	-0.049	0.639	0.000	0.000	0.000
$NCSKEW$	6351	-0.048	0.853	-0.518	-0.090	0.351
$DUVOL$	6351	-0.057	0.559	-0.414	-0.074	0.279
CFO_UAI	6351	0.358	0.049	0.350	0.350	0.350
STD_RET	6351	0.044	0.024	0.028	0.037	0.053
RET	6351	-0.122	0.149	-0.138	-0.069	-0.037
$\Delta TURN$	6351	0.000	0.037	-0.015	0.000	0.014
$SIZE$	6351	13.020	1.928	11.677	12.889	14.250
M/B	6351	2.656	3.931	1.110	1.900	3.240
LEV	6351	0.163	0.162	0.009	0.130	0.262
ROA	6351	0.045	0.111	0.018	0.057	0.095

Panel B: Correlation Matrix

	$COUNT$	$NCSKEW$	$DUVOL$	CFO_UAI	STD_RET	RET	$\Delta TURN$	$SIZE$	M/B	LEV
$NCSKEW$	**0.790**									
$DUVOL$	**0.651**	**0.901**								
CFO_UAI	-0.006	-0.002	0.002							
STD_RET	**0.066**	**0.134**	**0.122**	-0.007						
RET	**-0.066**	**-0.126**	**-0.115**	0.008	**-0.966**					
$\Delta TURN$	**0.033**	**0.060**	**0.039**	-0.003	**0.043**	**-0.040**				
$SIZE$	**0.061**	**0.055**	**0.072**	**0.127**	**-0.493**	**0.422**	0.014			
M/B	**-0.039**	**-0.067**	**-0.078**	0.020	**-0.109**	**0.090**	0.005	**0.168**		
LEV	0.021	0.028	**0.044**	0.004	**-0.051**	0.018	0.016	**0.192**	-0.029	
ROA	**-0.061**	**-0.093**	**-0.096**	**0.034**	**-0.451**	**0.456**	0.001	**0.294**	**0.158**	0.008

Notes: Table 2 Panel A presents the descriptive statistics and Table 2 Panel B presents the Pearson correlation coefficients between any two key variables (values in bold are significant at a 1% level). Definitions of the key variables are provided in the Appendix A. Continuous variables are winsorised at the 1st and 99th percentile.

Table 3. CFO Cultural Background and Stock Price Crash Risk

	COUNT	***NCSKEW***	***DUVOL***
	(1)	**(2)**	**(3)**
CFO_UAI_{t-1}	-0.329**	-0.504***	-0.350***
	(-2.51)	(-2.85)	(-3.12)
$NCSKEW_{t-1}$	0.023**	0.020	0.012
	(2.15)	(1.31)	(1.29)
STD_RET_{t-1}	4.221***	6.307***	3.256**
	(2.60)	(2.93)	(2.44)
RET_{t-1}	0.694***	0.862***	0.387**
	(2.99)	(2.76)	(2.03)
$\Delta TURN_{t-1}$	0.068	0.166	-0.015
	(0.30)	(0.57)	(-0.08)
$SIZE_{t-1}$	0.051***	0.084***	0.063***
	(8.74)	(9.93)	(11.79)
M/B_{t-1}	0.003	0.006**	0.003**
	(1.42)	(2.09)	(2.09)
LEV_{t-1}	0.023	0.044	0.041
	(0.39)	(0.54)	(0.77)
ROA_{t-1}	-0.011	-0.037	-0.020
	(-0.12)	(-0.30)	(-0.25)
$Intercept$	-0.582***	-1.537***	-1.280***
	(-5.09)	(-9.53)	(-12.47)
No. of Obs	6351	6351	6351
Adj. R^2	0.03	0.04	0.06
Year effects	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes

Notes: This table presents regression results for CFO UAI and stock price crash risk with FTSE All-Share firms from 1999 to 2015. Definitions of the key variables are provided in the Appendix A. Continuous variables are winsorised at the 1st and 99th percentile. T-statistics reported in parentheses are based on robust standard errors. *, ** and *** stand for significance at 10%, 5% and 1% levels, respectively.

Table 4. CFO UAI and Price Crash Risk: Controlling for CEO and Board UAI

	$\boldsymbol{COUNT}$	$\boldsymbol{NCSKEW}$	$\boldsymbol{DUVOL}$
	(1)	**(2)**	**(3)**
CFO_UAI_{t-1}	-0.316**	-0.454**	-0.297**
	(-2.30)	(-2.44)	(-2.47)
CEO_UAI_{t-1}	-0.029	0.003	-0.020
	(-0.27)	(0.02)	(-0.23)
$BOARD\_UAI_{t-1}$	-0.035	-0.390	-0.362*
	(-0.14)	(-1.29)	(-1.88)
$NCSKEW_{t-1}$	0.024**	0.021	0.013
	(2.19)	(1.38)	(1.36)
STD_RET_{t-1}	4.220***	6.330***	3.306**
	(2.61)	(2.95)	(2.48)
RET_{t-1}	0.695***	0.865***	0.391**
	(2.99)	(2.77)	(2.05)
$\Delta TURN_{t-1}$	0.068	0.165	-0.018
	(0.30)	(0.56)	(-0.10)
$SIZE_{t-1}$	0.051***	0.087***	0.066***
	(8.10)	(9.57)	(11.36)
M/B_{t-1}	0.003	0.006**	0.003**
	(1.42)	(2.06)	(2.03)
LEV_{t-1}	0.022	0.042	0.039
	(0.38)	(0.51)	(0.74)
ROA_{t-1}	-0.012	-0.045	-0.028
	(-0.13)	(-0.36)	(-0.35)
$Intercept$	-0.464***	-1.197***	-1.019***
	(-3.66)	(-6.87)	(-9.20)
No. of Obs	6350	6350	6350
Adj. R^2	0.04	0.06	0.07
Year effects	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes

Notes: This table presents regression results for CFO UAI and stock price crash risk with FTSE All-Share firms from 1999 to 2015, controlling for CEO and board UAI. Definitions of the key variables are provided in the Appendix A. Continuous variables are winsorised at the 1st and 99th percentile. T-statistics reported in parentheses are based on robust standard errors. *, ** and *** stand for significance at 10%, 5% and 1% levels, respectively.

Table 5. CFO UAI and Price Crash Risk: Controlling for Endogeneity

	$COUNT$	$NCSKEW$	$DUVOL$
	(1)	**(2)**	**(3)**
Panel A: Firm-fixed effects			
CFO_UAI_{t-1}	-0.537**	-0.537**	-0.399***
	(-2.06)	(-2.16)	(-2.72)
No. of Obs	6351	6351	6351
Adj. R^2	0.03	0.06	0.07
Year effects	Yes	Yes	Yes
Firm effects	Yes	Yes	Yes
Panel B: Difference-in-differences			
$POST$	-0.006	-0.078*	-0.029
	(-0.19)	(-1.89)	(-1.03)
$POST \times CFO\_DOWN$	0.120	0.196	0.183
	(0.97)	(1.32)	(1.64)
$POST \times CFO\_UP$	-0.152*	-0.172*	-0.110*
	(-1.79)	(-1.77)	(-1.67)
No. of Obs	2602	2602	2602
Adj. R^2	0.05	0.08	0.08
Year effects	Yes	Yes	Yes
Firm effects	Yes	Yes	Yes
Panel C: Propensity score matching			
$HCFO\_UAI_{t-1}$	-0.094*	-0.117*	-0.063
	(-1.84)	(-1.90)	(-1.55)
No. of Obs	512	512	512
Adj. R^2	0.02	0.01	0.05
Year effects	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes

Notes: This table presents the results for CFO UAI and stock price crash risk with FTSE All-Share firms from 1999 to 2015 using firm-fixed effect regressions (Panel A), difference-in-differences specification (Panel B), and propensity score matching approaches (Panel C). A full set of controls are included, but are not reported for simplicity (available upon request). $POST$ is an indicator variable which is equal to 1 if the firm-year is post-turnover event, and 0 otherwise. CFO_UP is an indicator variable which is equal to 1 if the incoming CFO has stronger UAI than the incumbent CFO, and 0 otherwise. CFO_DOWN is an indicator variable which is equal to 1 if the incoming CFO has weaker UAI than the incumbent CFO, and 0 otherwise. $HCFO\_UAI$ is an indicator variable which is equal to 1 if the firms retain CFOs with above industry median UAI, and 0 otherwise. Definitions of the key variables are provided in the Appendix A. Continuous variables are winsorised at the 1st and 99th percentile. T-statistics reported in parentheses are based on robust standard errors. *, ** and *** stand for significance at 10%, 5% and 1% levels, respectively.

Table 6. Subsample Analyses: Information Asymmetry

	COUNT **(1)**	***COUNT*** **(2)**	***NCSKEW*** **(3)**	***NCSKEW*** **(4)**	***DUVOL*** **(5)**	***DUVOL*** **(6)**
Panel A: Analyst coverage						
	High	Low	High	Low	High	Low
CFO_UAI_{t-1}	-0.081	-0.634***	-0.047	-0.803***	-0.138	-0.442**
	(-0.50)	(-2.86)	(-0.23)	(-2.66)	(-1.17)	(-2.08)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs	2919	3432	2919	3432	2919	3432
Adj. R^2	0.02	0.03	0.03	0.04	0.03	0.05
Panel B: Bid-ask spread						
	High	Low	High	Low	High	Low
CFO_UAI_{t-1}	-0.585**	-0.177	-0.912***	-0.226	-0.646***	-0.168
	(-2.17)	(-1.27)	(-2.65)	(-1.22)	(-3.07)	(-1.32)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs	3238	3108	3238	3108	3238	3108
Adj. R^2	0.04	0.01	0.05	0.02	0.06	0.02
Panel C: Financial statement comparability						
	High	Low	High	Low	High	Low
CFO_UAI_{t-1}	0.047	-0.481**	-0.192	-0.787***	-0.214	-0.613***
	(0.30)	(-1.97)	(-0.63)	(-2.95)	(-1.17)	(-3.77)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs	2071	2041	2071	2041	2071	2041
Adj. R^2	0.02	0.04	0.03	0.05	0.05	0.06

Notes: This table presents subsample regression results for CFO UAI and stock price crash risk with FTSE All-Share firms from 1999 to 2015, focusing on information asymmetry. $Analyst\ coverage$ is the number of analysts following. $Bid-ask\ spread$ is the annual average bid-ask spread calculated using daily ratio of the difference between ask price and bid price to the midpoint of ask price and bid price. $Financial\ statement\ comparability$ is the firm-level financial statement comparability calculated as the average of the four highest comparability scores for all *i-j* firm pairs in the same industry during period t. $Leverage$ is the ratio of long-term debt to total assets. $Percentage\ of\ independet\ directors$ is the ratio of the number of independent directors to the total number of directors on the board. Definitions of the key variables are provided in the Appendix A. All continuous variables are winsorised at the 1st and 99th percentile. T-statistics reported in parentheses are based on robust standard errors. *, ** and *** stand for significance at 10%, 5% and 1% levels, respectively.

Table 7. Subsample Analyses: Firm Risk

	COUNT	***COUNT***	***NCSKEW***	***NCSKEW***	***DUVOL***	***DUVOL***
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
			Panel A: Cash flow volatility			
	High	Low	High	Low	High	Low
CFO_UAI_{t-1}	-0.521***	-0.178	-0.844***	-0.222	-0.455**	-0.184
	(-3.06)	(-0.97)	(-2.88)	(-0.93)	(-2.21)	(-1.32)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs	2912	2889	2912	2889	2912	2889
Adj. R^2	0.03	0.02	0.04	0.04	0.06	0.05
			Panel B: Earnings volatility			
	High	Low	High	Low	High	Low
CFO_UAI_{t-1}	-0.320	-0.235	-0.577**	-0.357	-0.427**	-0.197
	(-1.52)	(-0.99)	(-2.09)	(-1.04)	(-2.42)	(-0.96)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs	3157	3162	3157	3162	3157	3162
Adj. R^2	0.03	0.04	0.04	0.05	0.06	0.06
			Panel C: Return volatility			
	High	Low	High	Low	High	Low
CFO_UAI_{t-1}	-0.504**	-0.208	-0.792***	-0.259	-0.588***	-0.158
	(-2.23)	(-1.14)	(-3.05)	(-1.20)	(-3.27)	(-1.29)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs	3235	3111	3235	3111	3235	3111
Adj. R^2	0.04	0.02	0.05	0.04	0.07	0.05
			Panel D: Expected default frequency			
	High	Low	High	Low	High	Low
CFO_UAI_{t-1}	-0.415*	-0.253	-0.678*	-0.351	-0.376	-0.367**
	(-1.69)	(-1.28)	(-1.93)	(-1.37)	(-1.51)	(-2.55)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs	2919	2536	2919	2536	2919	2536
Adj. R^2	0.04	0.02	0.05	0.03	0.06	0.05

Notes: This table presents subsample regression results for CFO UAI and stock price crash risk with FTSE All-Share firms from 1999 to 2015, focusing on firm risk. $Cash\ flow\ volatility$ is the standard deviation of quarterly cash flows from operations over the 16 quarters scaled by total debt. $Earnings\ volatility$ is the standard deviation of past eight earnings changes scaled by the average book asset over the past eight quarters. $Return\ volatility$ is the annualised volatility calculated using monthly stock returns from the previous year. $Expected\ default\ frequency$ is the probability that the value of a firm's assets will be less than the face value of its debt. Definitions of the key variables are provided in the Appendix A. All continuous variables are winsorised at the 1st and 99th percentile. T-statistics reported in parentheses are based on robust standard errors. *, ** and *** stand for significance at 10%, 5% and 1% levels, respectively.

Table 8. Subsample Analyses: CFO Influence

	$COUNT$	$COUNT$	$NCSKEW$	$NCSKEW$	$DUVOL$	$DUVOL$
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
			Panel A: CFO age			
	High	Low	High	Low	High	Low
CFO_UAI_{t-1}	-0.357**	-0.355*	-0.659***	-0.366	-0.516***	-0.231
	(-2.38)	(-1.65)	(-2.72)	(-1.63)	(-3.75)	(-1.43)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs	2903	3448	2903	3448	2903	3448
Adj. R^2	0.03	0.04	0.04	0.05	0.05	0.06
			Panel B: CFO relative pay			
	High	Low	High	Low	High	Low
CFO_UAI_{t-1}	-0.734***	0.144	-0.873**	0.068	-0.430	-0.136
	(-2.76)	(0.92)	(-2.42)	(0.33)	(-1.59)	(-1.03)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs	3096	3158	3096	3158	3096	3158
Adj. R^2	0.03	0.03	0.05	0.04	0.06	0.06

Notes: This table presents subsample regression results for CFO UAI and stock price crash risk with FTSE All-Share firms from 1999 to 2015, focusing on CFO influence. CFO age is the age of CFO. $CEO\ relative\ pay$ is the ratio of the CFO's total compensation excluding equity-based awards to the CEO's total compensation. Definitions of the key variables are provided in the Appendix A. All continuous variables are winsorised at the 1st and 99th percentile. T-statistics reported in parentheses are based on robust standard errors. *, ** and *** stand for significance at 10%, 5% and 1% levels, respectively.

Table 9. CFO UAI and Price Crash Risk: Controlling for Additional Controls

	$COUNT$ (1)	$NCSKEW$ (2)	$DUVOL$ (3)
Panel A: Controlling for other executive characteristics			
CFO_UAI_{t-1}	-0.349**	-0.494***	-0.341***
	(-2.49)	(-2.61)	(-2.69)
CEO_AGE_{t-1}	0.006	-0.041	0.013
	(0.10)	(-0.48)	(0.24)
CEO_TENURE_{t-1}	-0.005	-0.021**	-0.017***
	(-0.58)	(-2.01)	(-2.63)
CEO_GENDER_{t-1}	-0.044	-0.096	-0.032
	(-0.56)	(-0.96)	(-0.50)
CFO_AGE_{t-1}	-0.002	-0.001	-0.001
	(-1.14)	(-0.52)	(-0.48)
CFO_TENURE_{t-1}	-0.001	-0.001	-0.000
	(-0.62)	(-0.25)	(-0.07)
CFO_GENDER_{t-1}	-0.031	-0.064	-0.054*
	(-0.82)	(-1.32)	(-1.71)
No. of Obs	6240	6240	6240
Adj. R^2	0.03	0.04	0.06
Panel B: Controlling for financial reporting quality			
CFO_UAI_{t-1}	-0.238*	-0.462**	-0.355***
	(-1.81)	(-2.58)	(-3.16)
$OPAQUE_{t-1}$	0.146	0.214	0.044
	(0.85)	(0.85)	(0.27)
$OPAQUE^2_{t-1}$	-0.012	0.090	0.264
	(-0.05)	(0.23)	(0.99)
C_SCORE_{t-1}	-0.050	0.017	0.031
	(-1.17)	(0.28)	(0.79)
No. of Obs	5217	5217	5217
Adj. R^2	0.03	0.04	0.06
Panel C: Controlling for corporate governance characteristics			
CFO_UAI_{t-1}	-0.322**	-0.488***	-0.346***
	(-2.46)	(-2.78)	(-3.12)
$BOARD\_SIZE_{t-1}$	0.000	-0.020	-0.015
	(0.01)	(-0.39)	(-0.44)
$DUALITY_{t-1}$	-0.008	0.016	-0.001
	(-0.39)	(0.62)	(-0.04)
NED_RATIO_{t-1}	0.065	0.055	0.018
	(1.03)	(0.65)	(0.30)
No. of Obs	6351	6351	6351
Adj. R^2	0.03	0.04	0.06

(Continued)

Panel D: Controlling for the CFO equity incentives			
CFO_UAI_{t-1}	-0.322**	-0.487***	-0.341***
	(-2.43)	(-2.72)	(-3.01)
$EQUITY\_INCENTIVE_{t-1}$	0.039	0.093**	0.050
	(1.09)	(1.97)	(1.62)
No. of Obs	6351	6351	6351
Adj. R^2	0.03	0.04	0.06
Panel E: Controlling for Hofstede's cultural dimensions			
CFO_UAI_{t-1}	-0.326	-0.564**	-0.332*
	(-1.62)	(-2.33)	(-1.94)
CFO_PDI_{t-1}	-0.136	-0.080	-0.043
	(-0.56)	(-0.28)	(-0.20)
CFO_IDV_{t-1}	0.083	-0.042	0.061
	(0.54)	(-0.21)	(0.42)
CFO_MAS_{t-1}	-0.216	-0.190	-0.059
	(-1.55)	(-0.65)	(-0.28)
No. of Obs	6351	6351	6351
Adj. R^2	0.03	0.04	0.06
Panel F: Controlling for the effect of internationalisation			
CFO_UAI_{t-1}	-0.263**	-0.372**	-0.239**
	(-2.03)	(-2.23)	(-2.15)
$FOREIGN\_SALES_{t-1}$	0.047	0.063	0.025
	(1.39)	(1.37)	(0.84)
$BOARD\_FOREIGN_{t-1}$	-0.061	-0.163**	-0.129**
	(-1.05)	(-2.11)	(-2.56)
No. of Obs	5686	5686	5686
Adj. R^2	0.03	0.04	0.06
Panel G: Controlling for the most frequent foreign CFOs			
CFO_UAI_{t-1}	-0.324**	-0.505***	-0.357***
	(-2.41)	(-2.79)	(-3.11)
CFO_USA_{t-1}	-0.008	0.001	0.011
	(-0.13)	(0.01)	(0.22)
No. of Obs	6351	6351	6351
Adj. R^2	0.03	0.04	0.06
Panel H: Controlling for the effect of CFO foreignness			
CFO_UAI_{t-1}	-0.231	-0.401*	-0.261*
	(-1.44)	(-1.80)	(-1.75)
$CFO\_FOREIGN_{t-1}$	-0.032	-0.034	-0.029
	(-0.89)	(-0.73)	(-0.90)
No. of Obs	6351	6351	6351
Adj. R^2	0.03	0.04	0.06

Notes: This table presents the results for CFO UAI and stock price crash risk with FTSE All-Share firms from 1999 to 2015, controlling for additional controls. A full set of controls are included, but are not reported for simplicity (available upon request). Definitions of the key variables are provided in the Appendix A. Continuous variables are winsorised at the 1st and 99th percentile. T-statistics reported in parentheses are based on robust standard errors. *, ** and *** stand for significance at 10%, 5% and 1% levels, respectively.